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Assessment of Fatigue in Deployed Critical Care Air Transport Team Crews



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14. ABSTRACT This research investigated pre-deployment fatigue management training, as well as sleep patterns, level of fatigue, and fatigue countermeasures used in theater by Critical Care Air Transport Team (CCATT) members. CCATTs provide care to critically ill and injured patients during aeromedical transport. CCATT crewmembers are not classified as aircrew; thus, they do not operate with the same crew rest regulations as other aircrew. During high operational tempos in the Operation Iraqi Freedom and Operation Enduring Freedom conflicts, anecdotal reports indicated fatigue concern with this population. The study was conducted in three phases: a pre-deployment survey, in-theater activity monitoring (Bagram or Kandahar from August 2012 to August 2013), and an end-of-deployment survey. During the 2-week participation period, daily sleep patterns and fatigue countermeasures were recorded via actigraphy and sleep logs for a 14-day period and fatigue assessment data were collected pre-, during, and post-mission. Pre-deployment surveys were completed by 50 subjects (18 physicians, 17 nurses, and 15 respiratory therapists). Results showed that 88% of physicians, 73% of nurses, and 58% of respiratory therapists received at least 1 hour of fatigue management training. Twenty-three deployed CCATT members participated in the in-theater activity monitoring. Average sleep times during a 24-hour period for study participants at Bagram and Kandahar were approximately 7.8 hours and 7.0 hours, respectively. During the study period, 89% of all participants reported using caffeine at least once, followed by physical activity at 79%, naps at 62%, bright lights at 42%, and energy drinks at 32%. While subjective alertness ratings indicated a decrease in perceived alertness throughout a mission, objective vigilance measures do not appear to decrease throughout the mission, thus suggesting that while participants may have felt less alert, their reaction time performance appears to be unchanged. End of deployment questionnaires indicated none of the participants received fatigue management training throughout their deployment. Fatigue management training is a crucial part of pre-deployment education, especially for career fields with known fatigue concerns. As a result of the findings from this study, a pre-deployment fatigue management briefing was developed and made available for CCATT training. The in-theater data collected through this study only represent the ops tempo during this time period, which is considered to be much less than a few years prior. While the study does not capture fatigue issues that may have occurred during earlier years, a review of the general trends and fatigue management practices captured inform fatigue management practices in this environment.					
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1.0 SUMMARY

This research investigated pre-deployment fatigue management training, as well as sleep patterns, level of fatigue, and fatigue countermeasures used in theater by Critical Care Air Transport Team (CCATT) members. Additionally, subjective and objective methods were employed to assess fatigue levels to determine if a difference exists between the two measures.

CCATTs provide care to critically ill and injured patients during aeromedical transport. CCATT crewmembers are not classified as aircrew; thus, they do not operate with the same crew rest regulations as other aircrew. During high operational tempos in the Operation Iraqi Freedom and Operation Enduring Freedom conflicts, anecdotal reports indicated fatigue concern with this population.

The study was conducted in three phases: a pre-deployment survey, in theater activity monitoring, and an end-of-deployment survey. The paper-based pre-deployment survey was provided to study participants during their pre-deployment CCATT training at the Center for the Sustainment of Trauma and Readiness Skills Cincinnati. For the in-theater phase of the study, CCATT members deployed to Bagram or Kandahar participated in the August 2012 to August 2013 timeframe. During the participation period, daily sleep patterns and fatigue countermeasures were recorded via actigraphy and sleep logs for a 14-day period and fatigue assessment data were collected pre-, during, and post-mission during the 2-week period. The end-of-deployment survey was provided to CCATT members in the last 30 days of their deployment via survey monkey.

Pre-deployment surveys were completed by 50 subjects (18 physicians, 17 nurses, and 15 respiratory therapists). Results showed that 88% of physicians received at least 1 hour of fatigue management training. This was followed by the nursing group with 73% and the respiratory therapist group with 58%. Twenty-three deployed CCATT members participated in the in-theater activity monitoring. Average sleep times during a 24-hour period for study participants at Bagram and Kandahar were approximately 7.8 hours and 7.0 hours, respectively. During the study period, 89% of all participants reported using caffeine at least once, followed by physical activity at 79%, naps at 62%, bright lights at 42% and energy drinks at 32%. While subjective alertness ratings indicated a decrease in perceived alertness throughout a mission, objective reaction time measures do not appear to decrease throughout the mission, thus suggesting that while participants may have felt less alert, their reaction time performance appears to be unchanged. End of deployment questionnaires indicated none of the participants received fatigue management training throughout their deployment.

Fatigue management training is a crucial part of pre-deployment education, especially for career fields with known fatigue concerns. As a result of the findings from this study, a pre-deployment fatigue management briefing was developed and made available for CCATT training. The in-theater data collected through this study only represent the ops tempo during this time period, which is considered to be much less than a few years prior. While the study does not capture fatigue issues that may have occurred during earlier years, a review of the general trends and fatigue management practices captured inform fatigue management practices in this environment.

2.0 INTRODUCTION

The negative effects of fatigue have been identified as a commonality among healthcare professionals in both military and civilian settings. Long duty hours, minimal recuperation time, decreased opportunities to rest, and a lack of formal education on fatigue management techniques and normal circadian rhythms can detrimentally affect the health and performance of healthcare professionals in both the military and civilian healthcare domains [1]. Fatigue impairs neurobehavioral and cognitive performance in humans, and documented human errors in the medical domain have been linked with fatigue, workload, cognitive overload, poor communication, and flawed decision-making [1,2]. In summarizing the vast body of literature on the negative consequences of fatigue, Domen et al. found that nurses who worked longer than 12.5 hours were three times more likely to make a patient error. They also identified 68% of Certified Registered Nurse Anesthetists reported being excessively tired during the day, with 49% having witnessed a colleague asleep during a surgical case [3]. Not only does fatigue impact the quality of patient care, it also has personal consequences for the provider. Sleep loss in healthcare workers is associated with disturbances in mood, increased stress levels, decline in overall health, strain on personal relationships, dependency on alcohol, abuse of substances, and an increased risk of motor vehicle crashes [1].

Another area of focus that has historic fatigue issues is the aviation community. All aviation professionals, including flight crews, cabin crews, maintenance personnel, etc., are imperative to ensuring the safety of air travel. Unfortunately, in today's operations, aviators are expected to maintain peak performance while exposed to extended duty days, limited time off, austere sleeping conditions, jet lag, and non-standard work hours [4]. In a study completed by Roach et al., 46% of duty periods performed by long-haul pilots had high fatigue likelihood, while 5% had extreme fatigue likelihood [5]. With an estimated 4-7% of civil aviation mishaps, 4% of Army accidents, and 7.8% of Air Force Class A mishaps being linked to fatigue [6], research is needed to understand techniques to counter fatigue and optimize alertness for any individual who is at risk for operational fatigue.

Fatigue countermeasures are often used by individuals to mitigate the effects of fatigue and include tactics such as napping, taking breaks between activities, increasing the amount of light, and consuming stimulants such as caffeine [3]. Naps have been shown to provide temporary relief from the negative effects of fatigue, with a 2- to 8-hour nap prior to 24 hours of sleep loss improving vigilance for various occupations. Also, caffeine consumption has been shown to have alertness-enhancing effects depending on dosage [1].

Combining fatigue countermeasures has been found to be an effective method to enhancing performance. Combining a short nap with caffeine, light exposure, or face washing led to a marked performance improvement on computer tasks and decreased daytime fatigue [3].

A high number of healthcare and aviation professionals are using fatigue countermeasures. Seventy-seven percent of Certified Registered Nurse Anesthetists reported using fatigue-avoidance strategies while 87% reported using fatigue countermeasures [3]. Conversely, B-2 pilots in Operation Iraqi Freedom have reported using pharmacological agents such as dextroamphetamine to remain alert during military operations [6].

While the use of fatigue countermeasures, such as napping and caffeine consumption, has been researched in occupational settings, there are several environments where fatigue countermeasure research is limited. One area of interest with inadequate research on fatigue countermeasures and management is the air transport domain, as these providers are challenged

with providing medical care while being exposed to the stresses of flight. Critical Care Air Transport Teams (CCATTs) provide medical care for the critically ill and injured patients during aeromedical transport. A team comprises a critical care physician, nurse, and respiratory therapist. These teams are known to work in high operational tempos, oftentimes with back-to-back missions, with limited time for rest and recuperation. CCATT crewmembers are not classified as aircrew; thus, they are not governed by standard aircrew regulations intended to prevent the negative effects of fatigue. CCATTs transport patients thousands of miles, through multiple time zones, and are exposed to the various stresses of flight in precarious environments for prolonged periods of time [7]. Due to time zone differences, lack of rest regulations, and mission departure times, CCATTs are exposed to extended periods of wakefulness and disruptions in their natural circadian rhythm, which could affect their performance [8]. In the CCATT environment, it is essential for personnel to perform at peak awareness and vigilance, and impairment in CCATT members due to fatigue could result in disastrous effects for both crew and patients.

Air Force leadership became concerned about fatigue safety issues after receiving anecdotal reports regarding the operational demands of CCATT missions lasting over 24 hours. Thus, this study aimed to improve understanding of fatigue management in the unique CCATT environment. The project included three phases: (1) pre-deployment questionnaire, (2) in-theater activity monitoring, and (3) end-of-deployment questionnaire.

3.0 METHODS

This project was conducted with the approval and oversight of the Air Force Research Laboratory Institutional Review Board protocol number FWR20120099H and U.S. Army Medical Research and Materiel Command Institutional Review Board protocol number M-10232. All study equipment was safe-to-fly certified through the Safe-to-Fly Lab at Wright-Patterson AFB on the C-17, C-130, and KC-135. In-theater approvals were coordinated through the JC2RT 12, 13, and 14. This study involved three phases: pre-deployment questionnaire, in-theater activity monitoring and end-of-deployment questionnaire.

3.1 Phase 1: Pre-Deployment Questionnaire

This phase focused on the fatigue management training and practices pre-deployment. Subjective data were collected to characterize participant sleep quantity and fatigue countermeasure strategy pre-deployment.

3.1.1 Participants. CCATT members were given the opportunity to complete the paper-based questionnaire during their pre-deployment training at the Center for the Sustainment of Trauma and Readiness Skills (C-STARS) in Cincinnati, OH, from October 2012 through April 2013. Fifty responses were acquired from members including physicians (n=18, 36%), nurses (n=17, 34%), and respiratory therapists (n=15, 30%). There were 36 male participants and 14 female participants. The majority of the participants were active duty Air Force, with five from the Air National Guard and five from the Air Force Reserves.

3.1.2 Questionnaire. The questionnaire included 11 questions on demographics, deployment history, sleep history, fatigue management training, and fatigue countermeasures. Figure 1 provides the survey questions. Responses were analyzed by CCATT specialty (e.g., physician, nurse, and respiratory therapist), gender, and duty status. Descriptive statistics were employed to analyze these data.

1. Please indicate your role on the CCATT team.					
Physician	Nurse	Respiratory Therapist			
2. Please circle your gender.					
Male	Female				
3. Please indicate if you are:					
Active Duty	Air Reserve	National Guard			
4. Please indicate your total number of OIF/OEF deployments lasting more than 3 month (including CCATT deployments).					
0	1	2	3	4+	
5. Please indicate your total number of OIF/OEF CCATT deployments.					
0	1	2	3	4+	
6. How long was your most recent deployment?					
< 1 month	1-3 months	3.1-6 months	6.1-9 months	> 9 months	
7. Were you able to get adequate sleep during deployment?					
Never	Rarely	Sometimes	Very Often	Always	
8. Please indicate any additional fatigue management training that you received during deployment?					
None	1-2 hrs.	2-3 hrs.	3-4 hrs.	>4 hrs.	
9. During deployment, what fatigue countermeasures did you use (circle all that apply)?					
Caffeine	Energy Drinks	Naps	Bright Light	Physical Activity	Pharmaceuticals
Other _____					
9a. If Energy Drinks, please indicate the type/brand name _____					
10. During deployment, what fatigue countermeasure worked best for you?					
Caffeine	Energy Drinks	Naps	Bright Light	Physical Activity	Pharmaceuticals
Other _____					
11. During deployment, what fatigue countermeasure was used the most?					
Caffeine	Energy Drinks	Naps	Bright Light	Physical Activity	Pharmaceuticals
Other _____					

Figure 1. Pre-deployment questionnaire.

3.2 Phase 2: In-Theater Activity Monitoring and Fatigue Management Assessment

This phase addresses the following aims: (1) investigate the sleep patterns in deployed CCATT members deployed to Bagram and Kandahar, Afghanistan, to examine differences between location and specialty; (2) compare sleep patterns on days with scheduled missions, unscheduled missions, and no missions; (3) assess the level of fatigue in deployed CCATTs before, mid-, and post-missions; and (4) explore supplements used to counter fatigue in the CCATT environment.

3.2.1 Participants. Twenty-three CCATT members participated in this study. Eleven participants were at Bagram, Afghanistan, and 12 were at Kandahar, Afghanistan. The participation period was 2 weeks and occurred from August 2012 through July 2013. During the study, there were three missing data sets for a total of four respiratory therapists, seven nurses and nine physicians. Ten crewmembers participated during fall and winter and 13 participated during spring and summer.

3.2.2 Sleep Log. Participants recorded sleep details, mission information, and fatigue countermeasures used in a sleep log for their 2-week participation period. Sleep information included timing details, frequency, and duration for any sleep period including naps. These data served as a secondary check of the actigraphy data. Missions were categorized as scheduled or unscheduled, and mission duration was recorded. These data provided researchers mission data to align with fatigue assessment tasks.

3.2.3 Actigraphy. During the 2-week study period, participants continuously wore an actigraph. These devices detect movement to infer rest/sleep periods. Researchers used Respironics Actiware software version 5.71.0 (Philips Respironics, Murrysville, PA) to analyze the actigraphy data. During the scrubbing process, individuals were removed if their actigraphy device was removed or malfunctioned. Individuals who had visible intervals where they took the actigraphy device off or the actigraphy device malfunctioned were also removed from the analysis.

Each individual's actigraphy data were then visually compared to that participant's sleep log responses. Rest and sleep intervals were adjusted to reflect the more accurate of the two sources. In general, actigraphically determined sleep was used as the default while sleep log responses were taken into account. Sleep intervals were manually cleared and recalculated when discrepancies were found between the log entries and actigraphy data.

Once all actigraphy data were scrubbed, Actiware scoring produced estimates of sleep for each individual for each minute that the actigraphy watch was worn. The average amount of sleep during the participation period was calculated and Excel (Microsoft, Redmond, WA) and SPSS (IBM, Armonk, NY) were used to analyze the actigraphy data.

3.2.4 Fatigue Assessment Tasks. Subjective and objective measures were used to assess fatigue during this study. Subjective fatigue was recorded using a visual analog scale (VAS). A personal digital assistant (PDA) based psychomotor vigilance task (PVT) was used as an objective measure.

3.2.4.1 PVTs. AT&T Tilt PDAs (Dallas, TX) were used to administer the PVT to determine mean reaction time lapses. Participants were required to press a button whenever a light on the PDA randomly appeared. The total time for this task was 5 minutes.

3.2.4.2 VAS. The VAS is a subjective measurement tool to assess the participants' attitudes. Adjectives evaluated in this study were "sleepy" and "alert." The adjective is accompanied by a line with one end representing "not at all" and the other "extremely." During each assessment period, participants put a mark on the line indicating their current state for each adjective.

3.3 Phase 3: End-of-Deployment Questionnaire

Work conducted in this phase focused on assessing fatigue in the CCATT environment during the last 2 months of a 6-month deployment.

3.3.1 Participants. Due to the reduction of deployed CCATT crew members during the study period and difficulty reaching CCATT members at the end of their deployment, fewer individuals participated in this phase than originally anticipated. Eight responses were obtained from participants including five physicians, two nurses, and one respiratory therapist. There were five male participants and three female participants. All of the participants were active duty Air Force.

3.3.2 Questionnaire. This questionnaire was administered online through Survey Monkey and focused on identifying additional fatigue management training received during deployment, fatigue countermeasure usage, and sleep quantity during deployment. This phase was intended to serve as a secondary source of information collected in phases 1 and 2.

4.0 RESULTS

4.1 Phase 1: Pre-Deployment Questionnaire

From the pre-deployment questionnaire, 50 responses were obtained. Figure 2 displays the breakdown of participants by specialty. Out of the 50 responses, 36% were physicians, 34% were nurses, and 30% were respiratory therapists. The majority of participants were active duty Air Force, with five from the Air Force Reserves and five from the Air National Guard.

The duration of fatigue management training that CCATT personnel received before deployment is displayed in Figure 3. A total of 22% of participants stated that they received no fatigue management training, and the majority (52%) of CCATT members received only 1 to 2 hours of fatigue management training before being deployed. The majority (72%) of all participants stated that they received no fatigue management training outside of the Air Force.

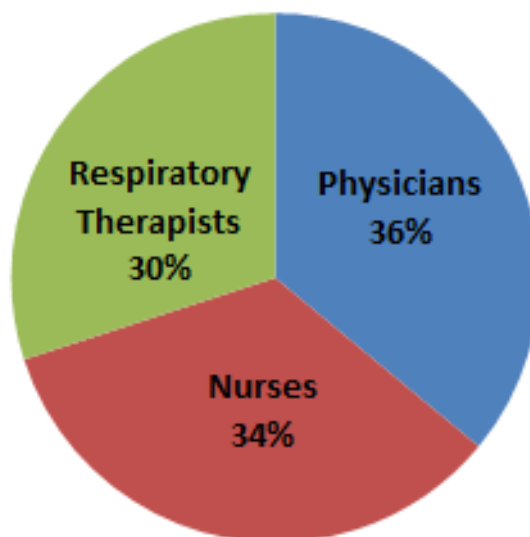


Figure 2. Participants by specialty.

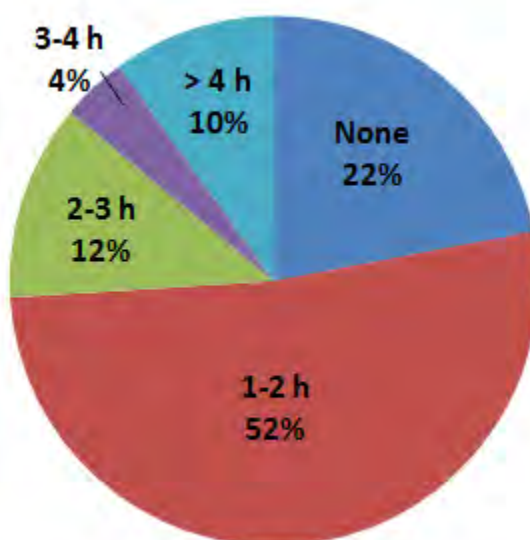


Figure 3. Air Force fatigue management training for CCATT personnel.

As shown in Figure 4, 88% of physicians, 73% of nurses, and 58% of respiratory therapists reported receiving at least 1 hour of fatigue management training.

Pre-deployment fatigue countermeasures strategies are summarized in Figure 5. Questions on pre-deployment fatigue countermeasures strategy found naps were employed by 60% and energy drinks were used by 32%. Only 11% reported using pharmaceuticals and 10% bright light. The majority of individuals used caffeine and physical activity to combat fatigue at 82% and 79%, respectively.

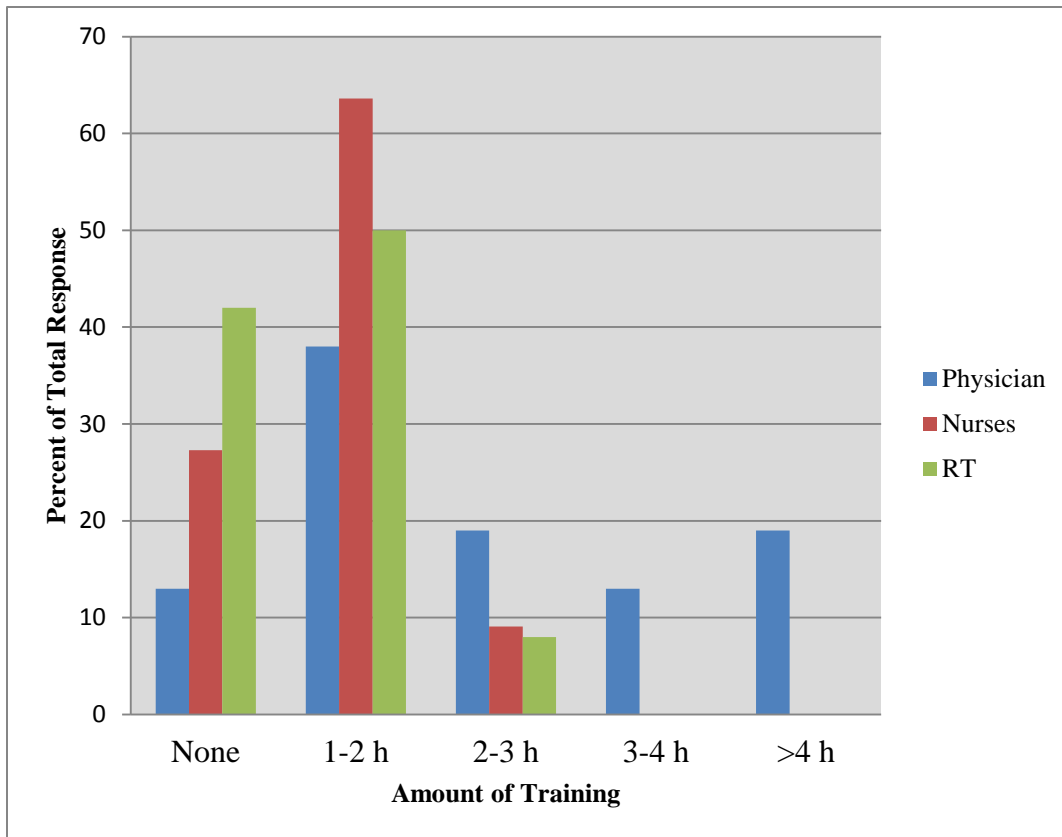


Figure 4. Amount of fatigue management training in the Air Force by specialty.

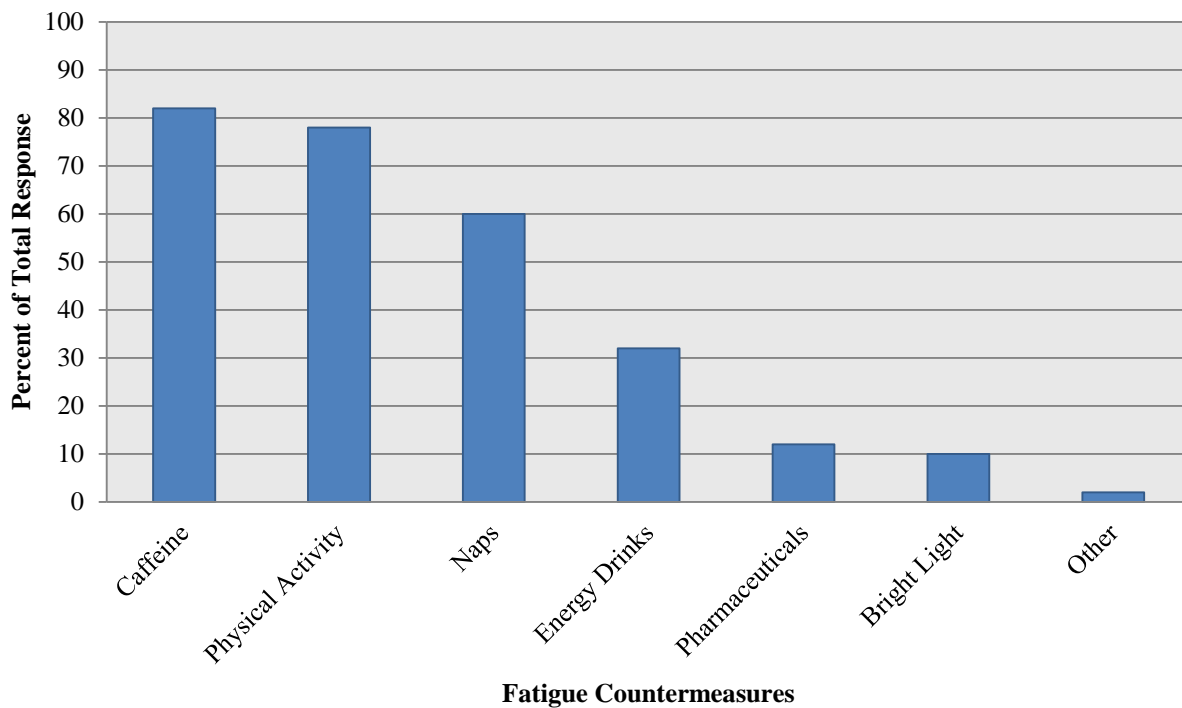


Figure 5. Fatigue countermeasures currently used.

4.2 Phase 2: In-Theater Activity Monitoring

From August 2012 through July 2013, 23 CCATT members (11 participants at Bagram and 12 at Kandahar) participated in this study. There were three incomplete data sets during the study period. Figure 5 shows the breakdown of participants by specialty. The majority of participants (57%) participated in the study during the spring/summer season.



Figure 6. Participants by specialty.

Figure 7 illustrates the reported use of fatigue countermeasures during the study period. Through the assessment of the self-report sleep logs, it was found that the majority of respondents used caffeine (89%) and physical activity (79%) at least once during the 2-week study period to combat fatigue. These were followed by naps (62%), bright lights (42%), and energy drinks (32%).

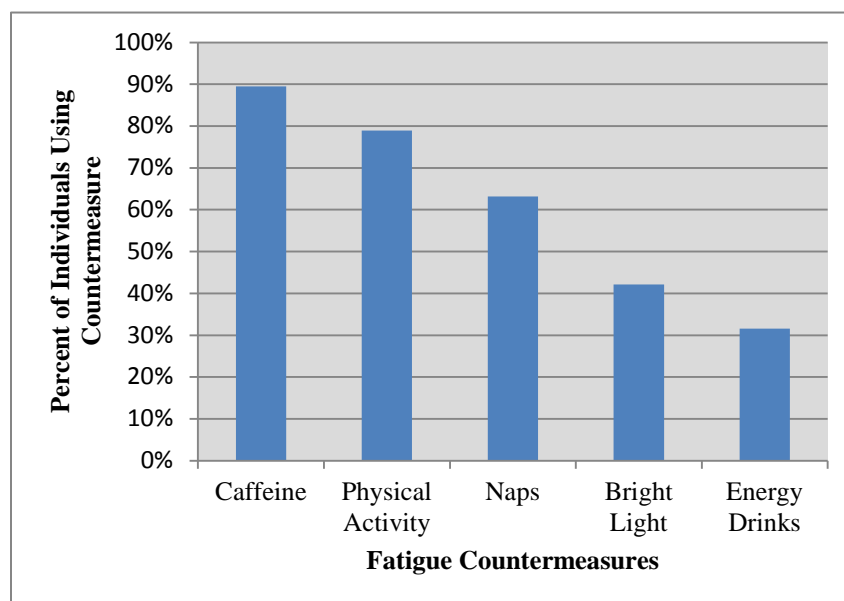


Figure 7. Percent of individuals using fatigue countermeasures at least once.

To investigate the frequency of countermeasure use, countermeasures were analyzed by study days. During the study period, there were 266 study days. Out of the 266 study days, the majority of days were spent with participants using caffeine (65%) and physical activity (41%) to combat fatigue. This was followed by 16% of the days containing naps, 11% containing bright light, and 7% containing energy drinks.

4.2.1 Sleep Log. During the study period, there were 19 missions from Bagram and 17 missions from Kandahar, for a total of 36 missions, shown in Table 1. Figure 8 shows the frequency of unscheduled and scheduled missions for both Bagram and Kandahar. These data were only representative of the CCATT missions of the study participants and are not all inclusive of all CCATT missions during this time period.

Table 1. Frequency of CCATT Missions by Season

Location	Fall 2012 – Winter 2013	Spring – Summer 2013	Total
Bagram	5	14	19
Kandahar	16	1	17
Total	21	15	36

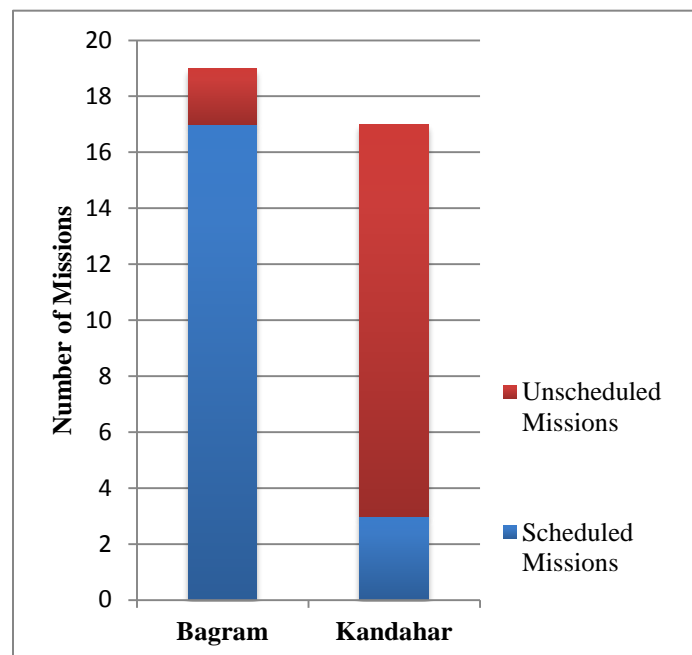


Figure 8. Frequency of CCATT missions for participants during study period.

Throughout the study, 55% of study participants used a sleep aid at least once. Ambien was reportedly used by 40% of participants, followed by Benadryl at 15%, Melatonin at 10%, Unisom at 10%, Lunesta at 5 %, and Restoril at 5% (data not shown). Table 2 shows the breakdown of participants who used a sleep aid at least once during the study period, with nurses having the highest use of sleep aids at 86%.

Table 2. Sleep Aid Usage

Usage	Physicians (n=9)	Nurses (n=7)	Respiratory Therapists (n=4)
Used sleep aid at least once	33%	86%	50%
Did not use sleep aids	67%	14%	50%

4.2.2 Actigraphy. The analysis of the actigraphy data found that participants at Bagram received a greater amount of daily sleep, with an average of 466.4 minutes compared to only 419.0 minutes at Kandahar, shown in Table 3.

Table 3. Average Sleep Time by Location

Location	Average Sleep Time (min)	Standard Deviation (min)
Bagram	466.4111	69.08814
Kandahar	418.9722	49.12211

Individuals who participated during the spring and summer months had a greater average sleep time of 492.3 minutes per 24-hour period compared to only 411.2 minutes for the individuals participating during the fall and winter months. Nurses, who reported taking the greatest amount of sleep aids, had the greatest amount of sleep at 479.98 minutes compared to 417.6 minutes and 443.3 minutes for the physicians and respiratory therapists, respectively, as seen in Tables 4 and 5.

Table 4. Average Sleep Time by Season

Season	Total Sleep Average (min)	Standard Deviation (min)
Fall/Winter	411.15	44.94416727
Spring/Summer	492.25	56.69180651

Table 5. Average Sleep Time by Specialty

CCATT Role	Average Sleep Time (min)	Standard Deviation (min)
Physician	417.637037	42.73213709
Nurse	479.98	77.34
Respiratory Therapist	443.2888889	67.4900411

Using the actigraphy data as well as the information provided in the self-report sleep logs, it was calculated that individuals received a greater amount of average daily sleep on days when there were scheduled missions when compared to days when there were no missions or unscheduled missions (Figure 9).

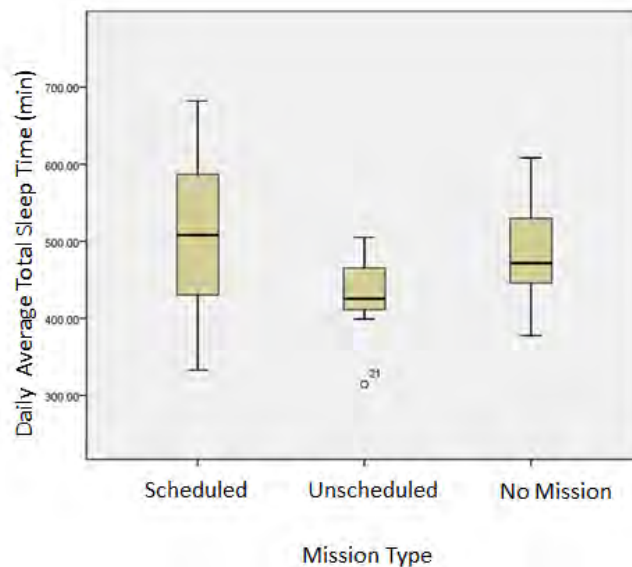


Figure 9. Daily average sleep time by type of mission.

4.2.3 PVT. Participants completed a 5-minute PVT at three points during each mission (pre, during, and post). Figure 10 shows that reaction time did not significantly differ throughout the mission. This is also true in Figure 11, which shows the number of lapses during the PVT throughout the mission.

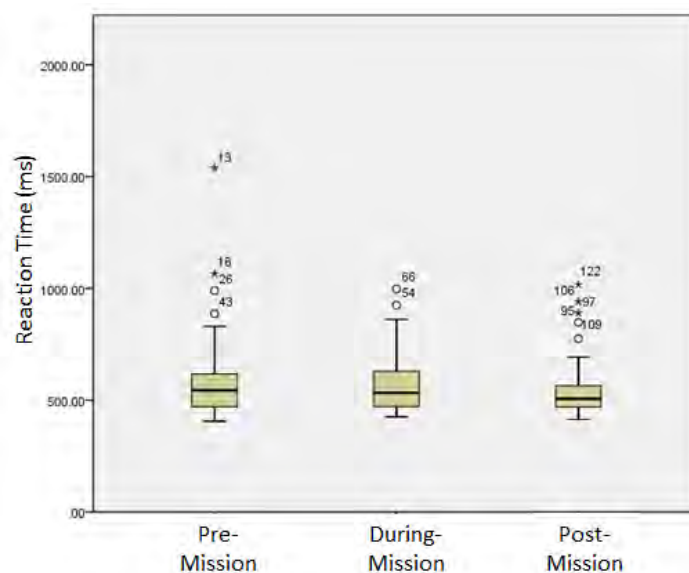


Figure 10. Reaction time during the 5-minute PVT.

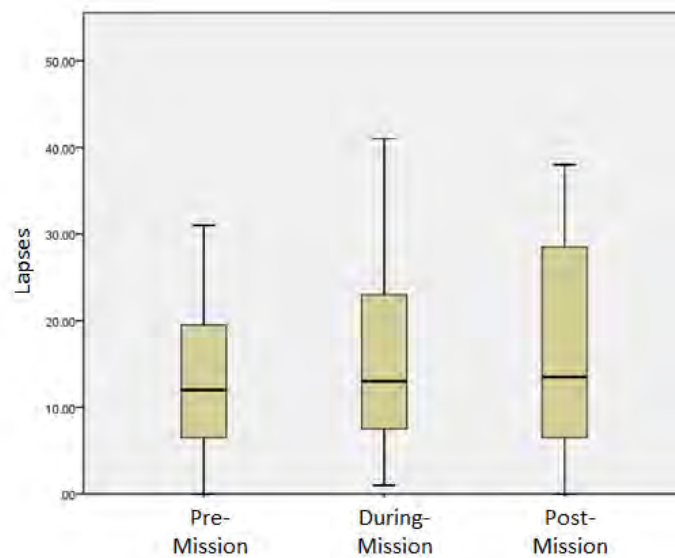


Figure 11. Amount of lapses during the 5-minute PVT.

4.2.4 VAS. A VAS was used to obtain subjective measures of alertness and sleepiness. Figure 12 shows individuals reported greater alertness during the pre-mission phase compared to during and after the mission. This information is validated in Figure 13, which shows individuals had higher sleepiness scores during the post-mission phase compared to before and during the mission.

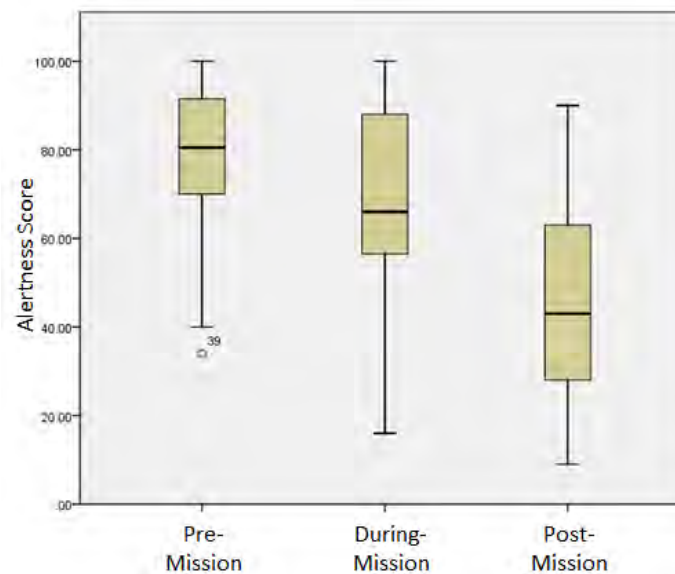


Figure 12. Subjective measure of alertness.

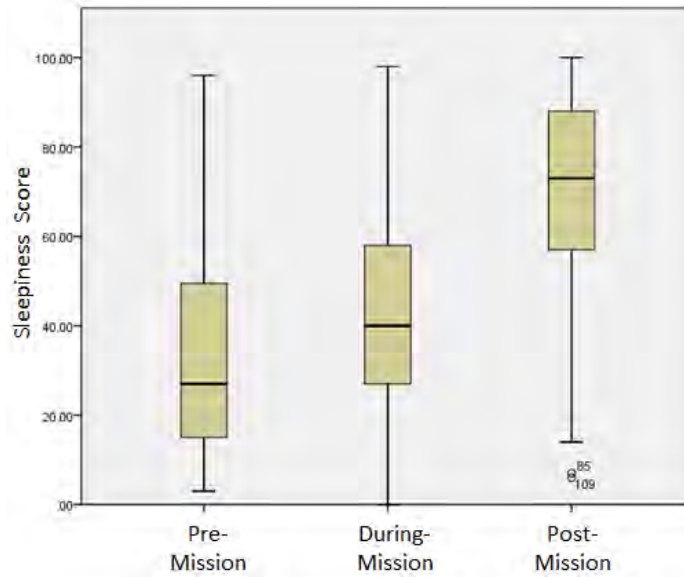


Figure 13. Subjective measure of sleepiness.

4.3 Phase 3: End-of-Deployment Questionnaire

The end-of-deployment questionnaire was given during the last 2 months of an individual's deployment, and during the study period, eight responses were obtained. There were five physicians, two nurses, and one respiratory therapist, with five male participants and three female participants. All of the participants were active duty Air Force. Three of the participants stated they had a scheduled mission during the week they answered the questionnaire and two individuals stated they had an unscheduled mission during the week prior to when they answered the questionnaire.

Figure 14 shows the responses pertaining to the following question: "Were you able to get adequate sleep during deployment?" The majority of individuals stated they received an adequate amount of sleep "very often" as compared to "sometimes" and "always." In the questionnaire, individuals were asked about their use of fatigue countermeasures, and it was found that 100% of individuals used caffeine at least once during their deployment to combat fatigue, followed by 88% of individuals who used physical activity to combat fatigue, as seen in Figure 15.

The majority of individuals (75%) stated that caffeine worked best for them compared to physical activity (12.5%) and taking naps (12.5%) to combat fatigue. Eighty-eight percent of individuals stated they used caffeine the most as compared with to other fatigue countermeasures in order to combat fatigue during deployment, which validates the information found in Phase 1 of the study. Of the individuals who used energy drinks to combat fatigue, the most common brand used was Monster, followed by Rip It, Red Bull, RockStar and Pitbull. Respondents who reportedly used pharmaceutical sleep aids took Ambien or Benedryl, which supports previous findings in Phase 2.

Fatigue management training was also assessed from the responses on the end-of-deployment questionnaire. All eight participants stated they did not receive any additional fatigue management training during deployment. This highlighted a need for continued fatigue management training.

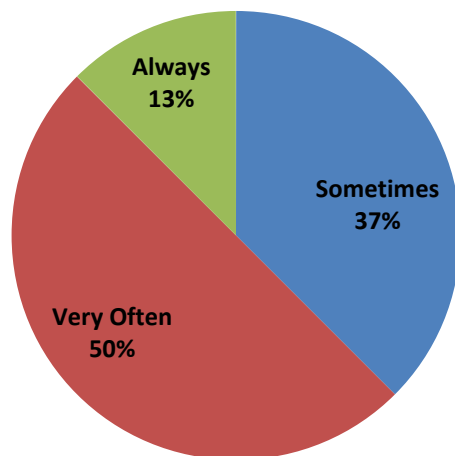


Figure 14. Frequency of adequate sleep during deployment.

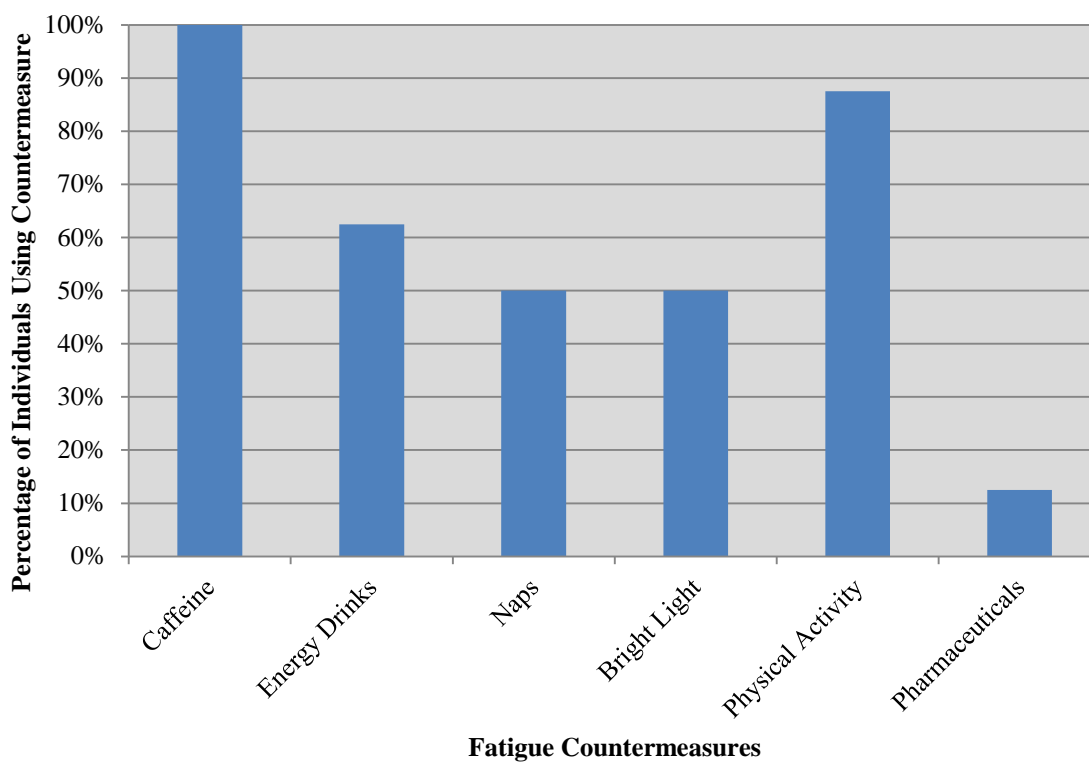


Figure 15. Usage of fatigue countermeasures.

5.0 LIMITATIONS

Although this study extended the knowledge of fatigue management in the CCATT environment, there were some limitations. The study only reflects data collected for study participants between August 2012 and July 2013. It is not all inclusive of the missions that were conducted in Bagram and Kandahar during the same time period.

As seen from data in phases 2 and 3, mission frequency during this period was much lower than in earlier years. As with any field study, data accuracy is reliant on subject compliance in the field, and while study personnel were located at the participant's deployed location, they were not present during the completion of the sleep log and fatigue assessment tasks. Regardless of the limitations, the primary objectives of this study were met. Also, the findings added to the current knowledge of the presence and effects of chronic fatigue in CCATT personnel.

This study highlighted the need for fatigue management training and, in turn, implemented changes for the CCATT domain. Research also captured what works in the field to influence future countermeasure strategies for this population, which has historically reported fatigue.

6.0 CONCLUSIONS

6.1 Phase 1: Pre-Deployment Questionnaire

CCATT personnel received more fatigue management training from the Air Force compared to outside the Air Force. However, 74% of all study respondents reported receiving less than 2 hours of training in this area, with 22% reporting no fatigue management training. This highlights a further need for fatigue management training.

As a result of findings from this phase, a pre-deployment fatigue management brief was developed and integrated into the pre-deployment training curriculum at C-STARS Cincinnati. From the investigation of fatigue countermeasure usage, caffeine and physical activity were found to be the most frequently used fatigue countermeasures by CCATT personnel as compared to energy drinks, naps, and bright lights.

6.2 Phase 2: In-Theater Activity Monitoring

Trends in the actigraphy data indicate less sleep was achieved on days with unscheduled missions as compared to days with scheduled missions and no-mission days. Participants based at Kandahar slept roughly 40 minutes less than participants based at Bagram. This difference was possibly due to more unscheduled missions.

Participants slept about 1.3 hours more in the spring/summer months than in the fall/winter. From the self-report sleep logs, it was found that caffeine was the countermeasure used by the majority of the participants, followed by physical activity, whereas energy drinks were only used by 32% of participants. These results confirm the findings from the pre-deployment questionnaire in phase 1 of the study. Approximately 55% of study participants used at least one sleep aid during the study period. Ambien was the most commonly used sleep aid, with 40% of the participants using the product at least once during the 2-week period.

The VAS trends suggested a reduction in subjective alertness, while the PVT trends for reaction time and lapse measures do not appear to change throughout the mission, thus suggesting that while participants may have felt less alert, their reaction time performance appears to be unchanged.

While anecdotal reports of fatigue in this population over the past several years were frequent, significant fatigue issues during this study period were not captured. This is likely due to a combination of the following factors: reduction in mission frequency, in-theater CCATT coordinator, and crew rest guidance for CCATTs.

While these findings did not highlight substantial fatigue concerns as anticipated, they did highlight in-theater fatigue management strategies for this population. They also provided a comparison between subjective and objective fatigue assessment measures.

6.3 Phase 3: End-of-Deployment Questionnaire

Responses to this phase were limited. However, one key finding was the variety of energy drinks consumed in this environment. These included the following: Monster, Red Bull, Rip It, Rip It Diet, and Pitbull Diet. In addition, all respondents indicated caffeine was the fatigue countermeasure used most during deployment, which agrees with findings from the in-theater activity monitoring phase.

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LIST OF ABBREVIATIONS AND ACRONYMS

C-STARS	Center for the Sustainment of Trauma and Readiness Skills
CCATT	Critical Care Air Transport Team
PDA	personal digital assistant
PVT	psychomotor vigilance task
VAS	visual analog scale